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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/880,975	06/13/2001	Thomas J. Sonderman	2000.045300	5882

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EXAMINER	
KIELIN, ERIK J	

ART UNIT	PAPER NUMBER
2813	7

DATE MAILED: 09/03/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/880,975	SONDERMAN ET AL.	
	Examin r	Art Unit	
	Erik Kielin	2813	

-- Th MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *11 June 2002* .

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-31* is/are pending in the application.

4a) Of the above claim(s) *2-6,13-21 and 23-31* is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1,7-12 and 22* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☒ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *13 June 2001* is/are: a)☐ accepted or b)☒ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

11)☐ The proposed drawing correction filed on _____ is: a)☐ approved b)☐ disapproved by the Examiner.

If approved, corrected drawings are required in reply to this Office action.

12)☐ The oath or declaration is objected to by the Examiner.

Priority under 35 U.S.C. §§ 119 and 120

13)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☐ All b)☐ Some * c)☐ None of:

1.☐ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____ .

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

14)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).

a) ☐ The translation of the foreign language provisional application has been received.

15)☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) _____ .
4) ☐ Interview Summary (PTO-413) Paper No(s). _____ .
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: .

DETAILED ACTION

Election/Restrictions

1. Applicant's election with traverse of the invention of group I, species Id, claims 7-12, in Paper No. 6 is acknowledged. The traversal is on the ground(s) that claim 22 is a linking claim and would not impose serious burden upon examiner to examine. This is not found persuasive because MPEP 806.05(e) states that if the process as claimed can be practiced by a materially different apparatus or by hand, then restriction is proper. Also, burden of search has already been established by the different classifications.

No arguments were presented traversing the grounds for restriction of Group III, claims 23-31. Because applicant did not distinctly and specifically point out the supposed errors in the restriction requirement, the election with respect to Group III has been treated as an election without traverse (MPEP § 818.03(a)).

In the interest of customer service, Examiner will consent to examine claim 22 along with the elected claims, 7-12, so long as claim 22 remains co-extensive in scope with elected species Id. **Accordingly the claims 1, 7-12, and 22 will be examined**.

Claims 23-31 are withdrawn from further consideration as being drawn to a non-elected invention. Claims 2-6 and 13-21 are withdrawn from further consideration as being drawn to non-elected species.

Drawings

2. The drawings are objected to as failing to comply with 37 CFR 1.84(p)(5) because they do not include the following reference sign(s) mentioned in the description: 1100. A proposed

drawing correction or corrected drawings are required in reply to the Office action to avoid abandonment of the application. The objection to the drawings will not be held in abeyance.

Specification

3. The disclosure is objected to because of the following informalities:

on p. 17, line 23, replace "102" with --1002-- for correct reference character;

on p. 22, line 24 replace "1019" with --1009-- for correct reference character;

on p. 25, line 21, replace "102" with --1002-- for correct reference character.

Appropriate correction is required.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

> A person shall be entitled to a patent unless –
>
> (e) the invention was described in-
> (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effect under this subsection of a national application published under section 122(b) only if the international application designating the United States was published under Article 21(2)(a) of such treaty in the English language; or
> (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that a patent shall not be deemed filed in the United States for the purposes of this subsection based on the filing of an international application filed under the treaty defined in section 351(a).

5. Claims 1, 7, and 22 are rejected under 35 U.S.C. 102(e) as being anticipated by US 6,428,673 B1 (**Ritzdorf** et al.) considered with **Wolf**, et al. Silicon Processing for the VLSI Era, Vol. 1-Process Technology, 2nd ed., Lattice Press: Sunset Beach CA, 2000, pp. 799-800.

Regarding claims 1 and 22, **Ritzdorf** discloses a method for controlling a thickness of an electroplated copper layer including damascene layers (col. 3, lines 10-21) using feedback from metrology comprising,

forming a first copper layer;

measuring an actual thickness of the copper layer;

comparing the actual thickness to a desired thickness; and

varying at least one parameter used to form the first copper layer in response to the actual thickness differing from the desired thickness. (See Abstract; col. 3, line 64 to col. 4, line 15; col. 4, lines 37-65; col. 5, lines 2-5; col. 7, lines 36-45; col. 8, lines 49-53.)

Ritzdorf does not describe the damascene process disclosed therein.

The basic textbook of **Wolf** discloses the basic copper damascene process known to one of ordinary skill also includes the formation of the dielectric with the opening, or in Applicant's claim language,

forming a first dielectric layer above a first structure layer (called "IMO deposition" in **Wolf**, Fig. 15-60, wherein IMO stands for intermetal oxide);

forming a first opening in the first dielectric layer (called "trench patterning and "via patterning");

forming a first copper layer above the first dielectric layer and in the first opening.

(See Wolf pp. 799-800, especially Fig. 15-60.)

It is seen to be inherent that the above steps are necessarily and inherently performed in the method of **Ritzdorf** because **Ritzdorf** discloses the method of providing process control feedback from metrology of thickness and uniformity data of a copper film in one embodiment

for a damascene process, and **Wolf** teaches that a damascene process is defined to include the aforementioned steps. (See MPEP 2112.)

Regarding claim 7, it is seen to be inherent that the actual thickness is measured at a plurality of locations, because **Ritzdorf** indicates that the uniformity is determined thereby requiring the thickness determination at several points.

Claim Rejections - 35 USC § 103

6. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

7. Claims 8-12 are rejected under 35 U.S.C. 103(a) as being unpatentable over **Ritzdorf** in view of US 6,298,470 B1 (**Breiner** et al.).

Regarding claims 8 and 9, the prior art of **Ritzdorf**, as explained above, discloses each of the claimed features except for indicating that the measuring of the thickness at a plurality of locations includes determining the average or median of the actual measured thickness.

Breiner teaches a method of process control during semiconductor fabrication by feedback from metrology tools (col. 3, lines 25-67) citing specific examples, wherein the data, including the thickness of deposited metal layers (col. 4, lines 20-25), is data that may be used to provide process control feedback. It is further indicated therein that,

> "The wafer data may be collected and tracked on a per wafer basis, per lot basis, per process run basis or combinations thereof. Further, the data

> may include **multiple measurements for each data point**, **mean values**, **median values**, range of values, standard deviations, wafer maps of the collected data, etc." (col. 4, lines 60-65).

It would have been obvious for one of ordinary skill in the art, at the time of the invention to use the average or median (called "mean" in **Breiner**) of the plurality of points measured in **Ritzdorf** as taught in **Breiner** as a matter of design choice because the average or median values would provide better a more precise measure of the thickness over the entire wafer than would a collection of un-analyzed thickness measurements.

Regarding claims 10-12, the prior art of **Ritzdorf**, as explained above, discloses each of the claimed features except for indicating that the measuring of the thickness at a plurality of locations, inherently disclosed in **Ritzdorf**, includes comparing the desired thickness to each of the plurality of measured thicknesses (claim 10) or comparing the desired thickness to the average (claim 11) or median values (claim 12) of the thickness.

As noted above, **Breiner** teaches that the any of the above-highlighted data (each of the plurality of thicknesses, the average thickness, or the median thickness) provide feedback for process control. Feedback necessarily requires comparison of measured data to some desired value, otherwise there would exist no direction in which to modify the process to move in the direction of the desired value, and consequently no control could be provided. Moreover, **Breiner** provides examples of process control based upon feedback of measured thickness (col. 6, lines 15-32 and col. 7, lines 15-38).

It would have been obvious for one of ordinary skill in the art, at the time of the invention to compare the measured data (each of the plurality of thicknesses, the average thickness, or the median thickness) as taught by **Breiner** in the method of **Ritzdorf**, because **Ritzdorf** indicates

that thickness and uniformity are data used to modify the process of depositing copper and because **Breiner** teaches that any of the measured data (each of the plurality of thicknesses, the average thickness, or the median thickness) may be used to provide feedback (i.e. comparison to a desired value) for process control.

Conclusion

8. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

US Patent Application 2002/0083401 (**Breiner** et al.) is a continuation application of that issuing as the **Breiner** patent applied above.

US 5,312,532 (**Andricacos** et al.) teaches measuring the thickness at a plurality of locations of electroplated copper and averaging the data and determining a standard deviation. (See Fig. 6a.)

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Erik Kielin whose telephone number is 703-306-5980. The examiner can normally be reached on 9:00 - 19:30 on Monday through Thursday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Olik Chaudhuri can be reached at 703-306-2417. The fax phone numbers for the organization where this application or proceeding is assigned are 703-872-9318 for regular communications and 703-872-9319 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is 703-308-0956.

Erik Kielin
August 29, 2002